Replaced by Article 34

Claims

1. A compact self-ballasted electrodeless discharge lamp comprising:

a bulb filled with discharge gas containing mercury and a rare gas;

an excitation coil installed near the bulb;

a ballast circuit which supplies high frequency power to the excitation coil; and

a base that is electrically connected to the ballast circuit,

wherein: the bulb, the excitation coil, the ballast circuit and the base are formed into an integral part;

the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

a recessed portion to which the excitation coil is inserted is formed on the ballast circuit side of the bulb;

the recessed portion has an opening section on the ballast circuit side, and has a tube shape with a virtually round shape in the cross section thereof, with a portion positioned on the side opposite to the opening section of the recessed portion being provided with a function for suppressing the convection of the discharge gas;

the largest diameter of the bulb is set in a range from not less than 60 mm to not more than 90 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.07 W/cm^2 to not more than 0.11 W/cm^2;

the ratio (h/D) of the height (h) of the bulb based upon the end face of

the opening section in the recessed portion to the largest diameter (D) of the bulb is set in a range from not less than 1.0 to not more than 1.3; and

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh, and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is Dc, the following relationship is satisfied: $\Delta h \leq 1.15 \times Dc + 1.25$ [mm].

2. The compact self-ballasted electrodeless discharge lamp of claim 1, wherein the diameter Dc and the distance Δh satisfy the following relationship: $\Delta h \geq 1.16 \times Dc - 17.4$ [mm].

3. The compact self-ballasted electrodeless discharge lamp of claim 1 or 2, wherein the largest diameter of the bulb is set in a range from not less than 65 to not more than 80 mm.

4. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 3, wherein: the excitation coil is constituted by a core and a coil wound around the core; and the center portion of the portion around which the coil is wound in the longitudinal direction of the core is positioned within a range that is apart from a plane on which the largest diameter of the bulb is located by a distance from not less than 8 mm to not more than 20 mm toward the ballast circuit side.

5. A compact self-ballasted electrodeless discharge lamp comprising:

a bulb filled with discharge gas containing mercury and a rare gas;

an excitation coil installed near the bulb;

a ballast circuit which supplies high frequency power to the excitation coil; and

a base that is electrically connected to the ballast circuit,

wherein: the bulb, the excitation coil, the ballast circuit and the base are formed into an integral part;

the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

a recessed portion to which the excitation coil is inserted is formed on the ballast circuit side of the bulb;

the recessed portion has an opening section on the ballast circuit side, and has a tube shape with a virtually round shape in the cross section thereof, with a portion positioned on the side opposite to the opening section of the recessed portion being provided with a function for suppressing the convection of the discharge gas;

the largest diameter of the bulb is set in a range from not less than 55 mm to not more than 75 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.05 W/cm^2 to less than 0.07 W/cm^2;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the

bulb is set in a range from not less than 1.0 to not more than 1.3; and

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh, and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is Dc, the following relationship is satisfied: $\Delta h \leq 1.92 \times Dc - 22.4$ [mm].

6. The compact self-ballasted electrodeless discharge lamp of claim 5, wherein: the diameter Dc and the distance Δh satisfy the following relationship: $\Delta h \geq 1.16 \times Dc - 17.4$ [mm].

7. The compact self-ballasted electrodeless discharge lamp of claim 5 or 6, wherein the largest diameter of the bulb is set in a range from not less than 60 mm to not more than 70 mm.

8. The compact self-ballasted electrodeless discharge lamp of any one of claims 5 to 7, wherein: the excitation coil is constituted by a core and a coil wound around the core; and the center portion of the portion around which the coil is wound in the longitudinal direction of the core is virtually positioned on a plane within which the largest diameter of the bulb is located.

9. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 8, wherein the mercury is enclosed in the bulb not in the

form of amalgam but in the form of mercury element.

10. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 9, wherein the filling pressure of the rare gas is set in a range from not less than 60 Pa to not more than 300 Pa.

11. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 10, wherein a phosphor layer is formed on an inner surface of the bulb.

12. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 11, wherein the diameter Dc of a portion positioned on the side opposite to the opening section of the recessed portion is greater than the diameter of a portion corresponding to virtually the center portion of the recessed portion in the longitudinal direction of the excitation coil.

13. An electrodeless-discharge-lamp lighting device comprising:

a bulb that is filled with discharge gas containing mercury and a rare gas, and has a recessed portion;

an excitation coil inserted in the recessed portion; and

a ballast circuit which supplies high frequency power to the excitation coil,

wherein: the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

the recessed portion has an opening section on the ballast circuit side, and has a tube shape with a virtually round shape in the cross section thereof;

the largest diameter of the bulb is set in a range from not less than 60 mm to not more than 90 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.07 W/cm^2 to not more than 0.11 W/cm^2;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the bulb is set in a range from not less than 1.0 to not more than 1.3; and,

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh, and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is Dc, the following relationship is satisfied: $\Delta h \leq 1.15 \times Dc + 1.25$ [mm].

14. An electrodeless-discharge-lamp lighting device comprising:

a bulb that is filled with discharge gas containing mercury and a rare gas, and has a recessed portion;

an excitation coil inserted in the recessed portion; and

a ballast circuit which supplies high frequency power to the excitation coil,

wherein: the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

the recessed portion has an opening section on the ballast circuit side, and has a virtually cylinder shape with a virtually round tube shape in the cross section thereof;

the largest diameter of the bulb is set in a range from not less than 55 mm to not more than 75 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.05 W/cm^2 to less than 0.07 W/cm^2;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the bulb is set in a range from not less than 1.0 to not more than 1.3; and,

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh, and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is Dc, the following relationship is satisfied: $\Delta h \leq 1.92 \times Dc - 22.4$ [mm].

15. The electrodeless-discharge-lamp lighting device of claim 13 or 14, wherein the diameter Dc of a portion positioned on the side opposite to the opening section of the recessed portion is greater than the diameter of a portion corresponding to virtually the center portion of the recessed portion in the longitudinal direction of the induction coil.

ABSTRACT

The present invention relates to a compact self-ballasted electrodeless discharge lamp in which: the largest diameter of a bulb **101** is set in a range from not less than 60 mm to not more than 90 mm and the bulb wall loading of the bulb **101** is set in a range from not less than 0.07 W/cm^2 to not more than 0.11 W/cm^2; and in this structure, the diameter Dc of the recessed portion **102** and the distance Δh between the top of the recessed portion **102** and the top portion of the bulb **101** are allowed to satisfy the following relationship: $\Delta h \leq 1.15 \times Dc + 1.25$ [mm].